

WE CLAIM:

1. A hoop stress relief mechanism for a solid rotary body with two faces and an outer rim, the mechanism comprising
a slot extending inwardly a distance from the outer rim and providing communication between the first face and the second face, the slot
5 having a first end at the outer rim and a second end, the slot also having a curved slot portion with a third end adjoining the second end and terminating at a tip.
2. The hoop stress relief mechanism described in Claim 1, wherein the slot is formed by an electric discharge wire machine.
3. The hoop stress relief mechanism described in Claim 1, wherein the slot is J-shaped with a linear slot portion at the first end.
4. The hoop stress relief mechanism described in Claim 3, wherein the linear slot portion is fabricated with a non-zero slot angle as defined as the angle between a tangent at the outer rim and a centerline of the linear slot portion where it intersects the outer rim.
5. The hoop stress relief mechanism described in Claim 3, wherein the slot has a non-perpendicular slash angle defined as angle a surface of the linear slot portion makes with a face of the rotary body.
6. The hoop stress relief mechanism described in Claim 1, wherein the rotary body is a turbine disk with a plurality of blades positioned around the outer rim.

7. The hoop stress relief mechanism described in Claim 6, wherein the blades are integrally cast.

8. The hoop stress relief mechanism described in Claim 1, wherein the rotary body has plurality of the slots about the outer rim.

9. The hoop stress relief mechanism described in Claim 8, wherein each slot of the plurality of slots is positioned between two adjacent blades.

10. The hoop stress relief mechanism described in Claim 8, wherein the curved slot portion of each slot of the plurality of slots is curved in the same direction.

11. The hoop stress relief mechanism described in Claim 1, wherein the slot is formed by a wire of an electric discharge wire machine.

12. The hoop stress relief mechanism described in Claim 1, wherein the distance between the tip and the linear slot portion is greater than 0.050".

13. The hoop stress relief mechanism described in Claim 1, wherein the tip angle is in a range of 20° to 80°.

14. A rotary body with an axis of rotation about which the rotary body rotates, the rotary body comprising
- a disk portion with an outer rim, a circular first face, and a circular second face, and
- 5 a slot with a linear slot portion extending inwardly a distance from the outer rim and providing communication between the first face and the second face, the slot having a first end at the outer rim and a second end, the slot also having a curved slot portion adjoining the second end of the linear slot portion, the curved slot portion with a top surface and a bottom surface, the
- 10 bottom surface being closer than the top surface to the axis of rotation of the rotary body.
15. The rotary body described in Claim 14, wherein the slot is formed by an electric discharge wire machine, which leaves a recast layer along all surfaces of the slot of the curved slot portion is fabricated with a thinner recast layer than other surfaces of the slot.
16. The rotary body described in Claim 14, wherein the bottom surface of the curved slot portion is formed from making two or more passes of the electric discharge wire machine along the bottom surface of the curved slot portion, each pass removing a portion of the recast layer along the bottom
- 5 surface of the curved slot portion, whereby the bottom surface is made smoother than other surfaces of the slot.

17. A gas turbine disk having integral blades and a hoop stress relief mechanism, the relief mechanism comprising

5 a slot with a linear portion and a curved portion, the linear portion extending inwardly a distance from an outer rim of the disk, the linear portion having a first end at the outer rim and a second end, the slot also having a curved portion adjoining the second end of the linear portion, the linear portion and the curved portion jointly extending through the disk to provide communication between a first face of the disk and the second face of the disk.

18. The gas turbine disk described in Claim 17, wherein the slot is fabricated by an electric discharge wire machine.

19. The gas turbine disk described in Claim 17, wherein the slot is positioned between two blades.

20. A method of providing a hoop stress relief mechanism comprising a slot with a linear slot portion and a curved slot portion, the slot fabricated in a rotary body with an outer rim, two faces, and an axis of rotation, the method comprising

5 continuously cutting the linear slot portion between the faces of the rotary body from the outer rim inwardly a distance to an inward end of the linear slot portion;

cutting the curved slot portion between the faces of the rotary body by continuing from the inward end, the curved slot portion bending back
10 towards the outer rim; and

spin balancing the rotary body.

21. The method described in Claim 20, wherein the steps of continuously cutting the linear slot portion and cutting the curved slot portion is

accomplished by an electric discharge wire machine to remove material in the rotary body to form the linear slot portion and the curved slot portion thereby,
5 the electric discharge wire machine leaving a recast layer along an inner surface of the linear slot portion and an inner surface of the curved slot portion.

22. The method described in Claim 21, further comprising the step of removing a part of the recast layer along the inner surface of the curved slot portion that is nearest the axis of rotation.

23. The method described in Claim 21, wherein the electric wire discharge machine makes at least a first pass and subsequent passes along the slot.

24. The method described in Claim 23, wherein the first pass defines the slot, and subsequent passes remove a part of the recast layer along the inner surface of the curved slot portion that is nearest the axis of rotation.

25. The method described in Claim 24, wherein the subsequent passes comprise three passes.

26. The method described in Claim 25, wherein all passes are made using a .008" wire.

27. The method described in Claim 26, wherein the three passes remove .00118" of the recast layer.

28. A method of fabricating a slot in a rotary body having an outer rim, two faces, and an axis of rotation, the slot having a linear slot portion extending from a first point at the outer rim to a second point situated inwardly a distance towards the axis of rotation, the slot further having curved slot portion
5 continuing from the second point and curving back towards the outer rim to terminate at a third end, the slot allowing communication between the two faces, the method comprising
- cutting the slot in the rotary body with wire of an electric wire discharge machine by making a first pass from the first point to the third point,
10 whereby the slot is formed;
- removing a first portion of a recast layer formed along a bottom surface of the curved slot portion by moving the wire inwardly towards the axis of rotation by a first offset and moving the wire in a second pass from the third point to the second point, the second pass being parallel with the path of the
15 first pass;
- removing a second portion of the recast layer formed along the bottom surface by moving the wire inwardly towards the axis of rotation by a second offset and moving the wire in a third pass from the second point to the third point, the third pass being parallel with the path of the second pass; and
20 removing a third portion of the recast layer formed along the bottom surface by moving the wire inwardly towards the axis of rotation by a third offset and moving the wire in a fourth pass from the third point to the second point, the fourth pass being parallel with the path of the third pass; whereby the total portion of the recast layer along the bottom surface that is
25 removed equals the sum of the first, second, and third offsets.

29. The method of fabricating a slot in a rotary body described in Claim 28, wherein the wire has a diameter of 0.008".

30. The method of fabricating a slot in a rotary body described in Claim 29, wherein the total portion of the recast layer that is removed equals 0.00118".

31. The method of fabricating a slot in a rotary body described in Claim 29, wherein the first offset is 0.00051", the second offset is 0.00063", and the third offset is 0.00004".